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Study regarding implementation of torrents' correction in the basin of production unit no. IX Slatina-Timiș, Teregova Forest District

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Abstract
The torrential rains that fell in the forest basins starting with 2017 produced torrential floods that affected the objectives under execution, causing significant damages. Significant portions of forest roads and torrent correction works were destroyed, and in many areas the traffic became impossible. The most important degradations that occurred are: breaking the road platform over significant lengths; degradation and, in some places, washing out the road superstructure; clogging of footbridges; degradation and/or destruction of defence/consolidation works (retaining walls, piers, gabions and others); undermining of art works; degradation and destruction of bridges and footbridges; broken art works; destabilization of slopes and landslides.
The destructive nature of torrential manifestations and the extent of the degradation produced, make timely and necessary interventions with torrential correction works in the torrential basins within the Teregova Forest District [7, 8]. The particularly high intensity of precipitation in recent years has produced floods that have led to the amplification of the degradation of the hydrographical network and adjacent lands, through deep erosion, surface erosion, landslides, collapses and bank collapses.

Keywords: torrent correction works, river basin, forest, pastures, hydrological improvement

Introduction

The forest fund is affected by torrential phenomena through erosion produced at the base of the slopes during floods, which favours landslides and landslides. From this point of view, the most exposed were the plots located in the immediate vicinity of the riverbeds. Considering both the natural setting and the socio-economic factors that have influenced the initiation and evolution of torrential processes, the technical measures applied on the basin slopes must be adapted accordingly. Their configuration depends on land use, the composition and structure of vegetation, as well as on the specific characteristics and severity of the degradation phenomena present.

Promoting sustainable and competitive forestry, while preventing environmental degradation due to anthropogenic activities, proposes, among other things, a careful monitoring of the managed torrential hydrographic basins in the forest area. This objective can only be achieved by managing torrential formations, rehabilitating existing works affected by floods or re-commissioning of works that have been taken out of use [4, 10].

Reality has shown that mountain regions, in general, and torrential areas in these regions, in particular, can neither be restored nor maintained at a sufficiently high economic and social level, to allow the exodus of rural population to the plains to be curbed, without resorting to the multi-purpose functions of the forest and to the technical methods of correcting torrents and conserving soil and water in mountain watersheds, methods that have been developed by foresters and with which they are best acquainted [8].

Material and method

The works in this study were carried out through: measures and works on the slopes of the basin, measures and works for hydrological improvement of the forest fund, measures and works for hydrological improvement of pastoral areas, the organization and practice of rational grazing, the development of green

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mass production and the development of the zootechnical sector. Also, the following methods were used: bibliographic documentation in the traditional form, which was based on materials from the ICAS archive and specialized literature; also, the Internet was used for documentation as well as discussions with various specialists; direct observations, measurements and laboratory analyses, carried out both expeditionary (on route) and stationary; the experiment, in the classic version; theoretical analysis (including statistical calculations) and logical interpretation of the results obtained [6,9].

The action of hydrological and anti-erosion management of torrential hydrographic basins is linked to the general action of restoring and protecting the environment and has an authentic forestry specific because only through forestry measures and works is it possible to restore the hydrological balance in areas with a low percentage of afforestation [2,5].

The way in which land is managed has a decisive influence on the triggering and dynamics of torrential and land degradation processes. The most intense processes take place in river basins with a low degree of afforestation (below 30%).

Results and discussions

Regarding the functional efficiency of afforestation works on degraded lands - Surface erosion on degraded afforested lands, previously used as pastures, was practically stopped after 5-15 years from the execution of afforestation works, in relation to the species (afforestation compositions) used, the nature and intensity of degradation, through the direct effect of protective forest crops; for example after 5-10 years, on moderately to heavily eroded slopes and 8-15 years, on very heavily to excessively eroded slopes [3,5].

The stabilization of lands affected by deep erosion processes and mass displacement occurred more slowly, because of the less active growth of the few forest species that could be installed in the seasonal conditions specific to these lands (scots pine, black pine, acacia, mountain ash, white Sea buckthorn, hawthorn, white alder).

Deep erosion was stopped on more than 80% of the surface, after a period of 10-20 years from the execution of the works of consolidating the riverbeds and slopes, and planting forest trees and shrubs, in the following situations: ditches located on slopes affected by strong to excessive erosion, after 10 years from the execution of the works; slopes, slopes and bottoms of ravines with reception basins having an area of less than 10 hectares, after 15 years from the execution of the works; slopes of ravines with reception basins having an area of more than 10 hectares, after 15-20 years from the execution of the works; banks of torrents, along the landings of transverse hydrotechnical works, after 10-15 years from the execution of the works.

Where there are no large concentrations of water from the runoff from the slopes, on small gullies and ravines, deep erosion was usually stopped only as a result of the effect of afforestation works, consisting of plantations of sea buckthorn or black pine seedlings in association with sea buckthorn, the seedlings were grown in polyethylene bags, and the planting was done with a bale at the root, without removing the bags, on vegetable reinforced terraces in association with sea buckthorn, after 10-15 years after the execution of the works.

On large deep erosion formations where afforestation works did not have adequate support with works to consolidate the hydrographical network, the stabilization of deep erosion was partially achieved, and in areas not affected by active processes of erosion and mass displacement of land, after 15-20 years after the execution of the works.

Mass movement processes (predominantly landslides) were stopped or considerably reduced, on more than 80% of the surface, after a period of 15-25 years from the execution of the works of consolidation of the riverbeds and slopes and of planting of forest trees and shrubs. The analyses carried out highlighted the following representative situations regarding the period of time after which the extinction of the movement processes or their considerable attenuation was achieved: superficial mudflows or plastic flows, after 15 years from the execution of the works; superficial landslides, after 10-15 years from the execution of the works; deep landslides, after 15-25 years from the execution of the works [1,2].

However, it is necessary to specify that the stabilization of lands affected by deep landslides (over 3 m) only through afforestation works has proven difficult or impossible without the execution of works to drain excess water and those to support and consolidate the base of the slopes. The functional efficiency of these works has increased over time, along with the growth and development of forest vegetation. After 20 - 25 years, under the effect of protective crops installed on degraded lands in torrential basins, the lands were stabilized between 91.3 - 92.2% of the surface, after 35 - 40 years, stabilization was achieved on more than 95% of the surface of degraded forested lands (95.4 -96.0 %).

Regarding the functional efficiency and behavior over time of the hydrotechnical works for the development of torrential hydrographic basins - From the analysis of the way in which the hydrotechnical works for the correction of torrents (respectively those for the consolidation of the torrentialized hydrographic network) have achieved their specific function, simultaneously with the examination of their current physical condition, the following more important findings were derived, for the main types of works executed and analyzed [3, 7].

Dams and thresholds made of stone masonry with cement mortar and concrete, works that require substantial investments and which aim to stem deep erosion and mitigate the negative effects of floods on large erosion formations, generally presented a good functional efficiency, having a special role both in the consolidation of the riverbed and in the consolidation of the embankments and direct slopes. Their role has been clearly highlighted in situations where they were located downstream of areas affected by active landslide or collapse processes [10].

The consolidation of riverbeds with judiciously placed and dimensioned hydrotechnical works has led to the formation of landings and the reduction of bottom and bank erosion, with the exception of areas located downstream of dams, insufficiently consolidated where, locally, erosion and deepening processes are still manifested. The analysis of the dynamics of the landing process (deposition of alluvium upstream of the transverse hydrotechnical works), over a period of 20 years, highlights a series of aspects, the most relevant of which is that the achieved settlement slope is significantly lower than that taken into account when designing the works. For this reason, the transverse hydrotechnical works show undermining of the embankments, requiring interventions to correct these deficiencies [7].

The research also highlights situations where the emphasis was placed on the execution of a large volume of hydrotechnical works, with exaggerated emphasis on ensuring a high alluvial retention capacity (i.e. on mitigating the effects). Under the specific conditions shown, of the torrential formations in the Curvature Subcarpathians area as well as other areas with similar conditions, after the retention capacity of the executed works has been exhausted, in situations where there has been no significant intervention with development works in the hydrographic basins, the alluvial transit and liquid flows remain substantially equal to those achieved before the transverse hydrotechnical works [3, 7].

These works are, in turn, exposed to continuous degradation over time. Some of these deficiencies are also due to the fact that the development works in the basin (on the slopes) have in most cases been of a limited nature, both in terms of hydrology and anti-erosion. It is necessary to specify that the failure to execute the entire complex of development works was mainly due to the fact that in the territories we are referring to there were different forms of ownership, and the necessary coordination and combination of financial and human efforts could not be achieved at the level of the entire hydrographic basin [7, 8].

Dry masonry thresholds, usually executed on torrential streams and ravines with small reception basins (under 10 ha), with narrow and stable beds, in a substrate of marls and sandstones that had large stone slabs on the bottom of the deep erosion formations, led to good results.

In all cases where the dry masonry was executed carefully, from large slabs, the thresholds

continue to perform well, having a high functional efficiency even after 40 years from execution. Damages were found in cases where small slabs were used or the works were not placed properly [10].

The stone masonry thresholds in gabions performed well, in situations similar to those presented for dry masonry thresholds, namely on torrential streams and ravines with small reception basins (under 10 ha), with narrow and stable beds.

The cement mortar masonry channels generally performed well functionally. The degradations they were subjected to were of minor importance and usually consisted of the pulling out of stones from the bottom base. The longitudinal stone works in gabions led to good protection of the roads, on the sectors along the torrential streams. The vegetal thresholds made of sea buckthorn fascicles; soil and stone experimented in the Bârseşti degraded land improvement perimeter, in the case of small ravines, led to very good results. The sea buckthorn in the fascine bed entered the vegetation in a high proportion (over 70%), leading after 3 years to the creation of true anti-erosion barriers [7, 8].

Grey alder seedlings planted on small landings and the bottom of ditches and ravines achieved higher percentages of attachment and maintenance and active growth so that, after the age of 8-10 years, they took over the function of consolidating the bottom of ditches and ravines, preventing erosion in depth. The functional behaviour of the vegetal thresholds proved superior to that of the wattle-works which, during floods, can be subject to undermining.

The thresholds made of polyethylene bags filled with soil also led to very good results in the experimental works carried out, in consolidating the bottoms of ditches and small ravines, in situations when these were accompanied by small artificial landings planted with grey alder.

Regarding the functional efficiency of longitudinal vegetative works for the defence and protection of torrential streams banks - The category of works with a small investment volume, based on the biological capacity of some forest species to ensure the protection of the banks, in sectors consolidated by transverse hydrotechnical works, includes the consolidation with rolls of sea buckthorn fascines, with a diameter of 30 cm, partially buried and fixed by stakes, in the bed of the riverbed, parallel to the bank to be protected. On the slope side, plantations with alder seedlings or cuttings with willow seedlings were carried out. Both the sea buckthorn in the fascines and the planted seedlings entered the vegetation, achieving good protection against bank erosion [6].

Regarding the functional efficiency of silvotechnical works for the consolidation and arrangement of the slopes and slopes adjacent to torrential streams, associated with protective forest crops - On the slopes in the vicinity of the torrentialized hydrographic network, with very strongly and excessively eroded lands, banks and slopes (often affected by mass movement processes), the reduction of degradation processes was achieved in most situations by installing forest vegetation.

In order to achieve the objectives of this intervention, continuous actions supported by appropriate technologies are required, ensuring at least the minimum conditions necessary for the stability and nutrition of forest trees and shrubs under such circumstances. Among the slope stabilization and improvement works applied in areas adjacent to the torrential hydrographic network, the most effective have proven to be: contour terraces reinforced with fences, placed at 2–3 m intervals on lands subject to severe or excessive erosion and on ravine slopes with soft rock substrates; terraces consolidated with dry stone masonry benches, implemented under conditions similar to those of fence-supported terraces, but adapted to skeletal soils with abundant rock content; and terraces stabilized with vegetative materials, such as branches, stems, and sea buckthorn shoots, applied to the same categories of land suitable for fence- or bench-supported terraces [7].

The types of forest crops that have shown good evolution and achieved high efficiency in stopping erosion on lands near the torrential hydrographical network (very strongly and excessively eroded slopes and slopes) have proven to be the following: acacia crops, on light to medium soils, from the forest-steppe to the sessile oak subzone; black pine crops mixed with deciduous trees (wild cherry, flowering ash, Turkish cherry, sanger, dogwood, etc.), on very strongly eroded lands as well as black pine crops in association with sea buckthorn, on very strongly to excessively eroded lands, from the forest-steppe to the spruce subzone; Scots pine crops, in mixtures similar to those shown for black pine, on the same categories of eroded lands, but with light to medium soils from the oak subzone to the middle part of the spruce subzone; sea buckthorn crops, on slopes and very strongly and excessively eroded lands, on slopes over 35 degrees, on substrates of marl with sandstone and gypsum, from the forest-steppe to the sessile oak subzone.

In conditions of relief, rock and precipitation, very favourable to the creation of a potential state of torrentially, the main factors that led to the triggering of torrential phenomena in the mountainous and hilly areas of our country and, implicitly, to the disruption of the hydrological regime of most watercourses, consisted of the alteration of the protective functions of the vegetation cover, and the disruption of the physical and biological functions of the soils.

In particular, through the irrational exploitation and wild destruction of forests - this important factor regulating the flow of watercourses - the conditions were created for the triggering of intense torrential phenomena, as a result of which almost all branches of the national economy suffer, year after year, directly or indirectly, significant damage.

Torrential and land degradation phenomena are felt over a much larger area than the one on which they occur, causing damage to the national economy mainly through:

- the decrease or even total loss of soil fertility;
- the disruption of the normal hydrological regime of natural watercourses, with all the particularly damaging consequences that arise from this disruption: favouring the occurrence of catastrophic floods; damage or destruction of objects intercepted by floods (industrial installations, hydroelectric facilities, communication routes, human settlements); clogging of reservoirs; raising the bed of large watercourses in the middle and lower areas.

Conclusions

The interpretation of the data obtained in this study leads to several key findings:

- the investigated basin covers an area of 210 ha and presents steep slopes with an altitude difference of 420 m. Under average gradients of 21%, the concentration of surface runoff on the slopes does not occur very rapidly.
- the Gravelius coefficient of 1.82 suggests that the basin has an elongated configuration, which favors the relatively fast concentration of flood flows in the control section.
- the hydrographic network extends over approximately 5000 m, with numerous branches that create a highly fragmented relief, characterized by short and steep slopes.
- due to the friable lithological substrate and the high velocity of flood flows, intense erosion processes are observed in the riverbeds, accompanied by landslides and bank collapses.
- the mean slope runoff time, representing the duration of water travel along the slopes, is 44.1 minutes, while the average travel time along the main channel from source to control section is 17.39 minutes.

- the average concentration time of runoff, i.e., the interval required for water to move from the most distant hydrological point to the basin outlet, was estimated at 61.49 minutes.
- high sediment transport has led to significant deposition processes, and due to the unstable channel morphology, severe floods may generate secondary drainage pathways.
- the hydrographic network is heavily degraded, with continuous deposition of sediments and morphological adjustments after each major flood.
- forestry exploitation within the catchment has left woody debris (branches, stumps, logs) in the channel, reducing the capacity of flow sections and diverting water onto potentially hazardous routes, particularly affecting the forest road.

Implementation of the planned improvement measures is expected to lead to a notable increase in meadow biomass productivity per unit area within the studied basin. Thus, from the estimates made, it results that currently the average production, the share on the total area is 8545 kg green mass/ha and it will increase in the future almost 2 times (16284 kg/ha).

These works contribute significantly to the restoration of the environment, especially in the segments that have been most strongly altered by torrential processes in the basin. During the execution, maintenance and repair of the works, part of the locally available workforce, especially in the rural area, is absorbed. Torrential development works contribute to the defence of objectives and assets that are or may be intercepted by floods, especially those of a catastrophic nature. Trees installed on degraded lands in the basin can satisfy various needs (wood for construction, arrack, forest fruits). By gradually reducing the differences between torrential erosion and the admissible one, the works we are referring to create favourable premises for a superior valorisation of the lands in the future, both economically and in terms of tourism and leisure activities.

References

[1] Konatowska, M., Rutkowski, P. (2019), *Phytosociology - A Useful Tool for the Assessment of Past and Future Human Impacts on Plants and Forest Ecosystems*, Journal of Biosciences and Medicines Vol.7 No.11
[2] Leahu, I. (2001), *Forest Management*, Ed. Didactica and Pedagogica, Bucharest
[3] Munteanu, S.A., Traci, C., Clinciu, I., Lazăr, N., Untaru, E., Gologan, N. (1993), *Development of torrential hydrographic basins through forestry and hydrotechnical works*. Vol. II. Romanian Academy Publishing House, Bucharest
[4] Nita, H. Shah, M.H., Bijal, S., Yeolekar, M. (2017), *Optimum Control for Spread of Pollutants through Forest Resources*, Applied Mathematics Vol.8 No.5
[5] Straka, T.J., & Layton, P.A. (2010), *Natural resources management: Life cycle assessment and forest certification and sustainability issues.* Sustainability, 2, 604-621
[6] Watts C.M. , Pile L.S. , Straka T.J. (2012), *Sustainability and Forest Certification as a Framework for a Capstone Forest Resource Management Plans Course*, Journal of Forestry Vol.2 No.3
[7] *** Forest arrangement of U.P. IX Slatina Timiș
[8] *** National Forest Strategy - 2022-2031
[9] *** Romania's national sustainable development strategy Horizons 2013-2020-20230
[10] ***Technical Norms for Forest management – 2022